Jamming, or deliberate interference against radio broadcasting stations

by V. K. Lehtoranta

As suggested by the title, this article discusses jamming of radio transmissions that were targeted to ordinary people. At one point of time, over 99 % of jamming originated from the areas of the ex-Soviet Union's sphere of influence.

The topics such as military operations and deliberate interference against commercial stations will be left outside the discussion here. The first case of the latter topic may be from the times of the revolution when Reichswehr with its 5-kW transmitter in Berlin jammed the telegraphy communications between Paris and Sankt Petersburg, Russia.

When the Soviet Union in the end of 1988 still managed to stop the massive jamming operation /1/ that lasted for over 40 years, even the most casual listener could sense the odd silence that had fallen over the HF broadcasting bands. For instance, a study made in Helsinki in April 1988 showed that, on the average, over one-third of the seven HF frequency bands reserved for broadcasting between 6 and 21 MHz were unusable for following almost whatever transmission because of jamming. After the Gulf War in the beginning of 1991, the HF or MW jamming stations that could still be heard here were operating primarily in the Middle East. In the summer of 1996, the World Jamming Club announced that actual jamming stations were still operational in the following countries: China, Cuba, Iran, Myanmar, North Korea, Vietnam and Turkey (TV). The target for Turkish jamming was the satellite transmissions of Kurdish Med-TV (Eutelsat ECS II F2, transponder 25). Jamming has been observed at least in the autumn of 1997 and in 1998, and it has been asserted that it originated from the Sinop uplink station on the coast of the Black Sea.

Issues related to deliberate jamming were naturally discussed in almost every important UN session and in international post-war radio conferences. For instance, after the complaints made by USA to the ITU, the UN General Assembly condemned deliberate jamming by 49 votes to 5 on 14 December 1950. Even in the 1982 ITU conference in Nairobi, Czechoslovakia (perhaps by order) made a proposal on legalisation of jamming.

During the years between 1984 and 1986 IFRB, by order of the ITU, organised a survey on deliberate jamming in four three-week periods. The operation was attended by more than 30 monitoring stations around the world with some kind of DF capability. In addition to the ordinary parametres, the morse ident (ID) of and the obtained bearing to the jamming stations were recorded. The monitoring results, besides the ITU's own documents, have been discussed in the note /2/, the supplemental maps of which reveal the commonly-known considerable inaccuracy of the HF DF systems. Although the DF system itself would be almost ideal (in this particular case they were not), the HF wave does not always propagate along the great-circle path, especially in long distances. Furthermore, when many stations (even jamming stations) were usually "one on the other", distinguishing them from each other mostly failed.

Photo 1. A sketch map over some HF jamming transmissions directed to Europe (here: to Poland in particular). The jammer IDs are roughly placed on the map on the basis of DF bearings. See also Radiomaailma 6−7/94.

* = transmitter site used for jamming
1G et al = hypothetical locations of transmitters that jammed Polish-language broadcasts. Estimates are based on bearings from European DF stations.

Photo 2 and 3. A 85-metre-tall "palm tree" antenna I photographed in 1991. The tower is also a support for lower-frequency cage dipoles seen in photo 7. The 45-degree "horns" (diagonal polarisation) are for higher HF frequencies. Some Lithuanian station operators said that the four-legged top section was difficult to get tuned. Pleikys' book has a series of photos that shows the demolition of this kind of structure in Vilnius on 28 April 1988.

A unique book

As Rimantas Pleikys /3/ from Lithuania says in his book "Jamming", which was published in the autumn of 1998, there was a special department for jamming in the Soviet Ministry of Communications, called "The Krestyaninova Section". The term was probably coined by Stanley Leinwoll, the former RFE frequency manager and a true specialist. It was estimated that in the 1980s the department headed by Natalya Krestyaninova had at its disposal 2,500−3,000 jamming transmitters of varied powers and at least 5,000 primary employees.

Of the countries under the Soviet control, so-called East European countries, Romania and Hungary ceased local jamming already in 1963−1964; however, in the end of 1968 some jamming stations also in Hungary resumed operations. In general, the majority of jamming transmitters operated in major transmitting sites in the actual Soviet territory. Some of these sites can be seen on the sketch map in photo 1. Pleikys' book contains photographs and tables of transmitters and antennas used for jamming, etc. Photos 2 and 3 show a "palm tree" antenna tower (height: 85−88 metres). These standard constructions that were used for jamming were seen for instance in all Baltic countries.

Radio Liberty (RL) and Radio Free Europe (RFE) /6/, which Ville Zilliacus in his memorandum /5/ placed into a category of their own, can be regarded as the absolute Number One targets for deliberate jamming. In his book Pleikys notes that the former of the two was a target for ceaseless jamming during the period of 23 March 1953 to 29 November 1988. Jamming against broadcasting stations that can be viewed as government-operated was a bit more selective. Still, during the time periods mentioned in the book, heavy jamming was targeted, for instance, against VOA, BBC, Deutshe Welle, Kol Israel and, oddly enough, perhaps also against Vatican Radio and Radio Tirana /7/. According to the table on the page 10 in the book, altogether 31 different countries were engaged in some degree of deliberate jamming at some stage. One of them was, for instance, England which during the Cyprus crisis in the end of 1950s jammed the Greek transmissions and vice versa. Likewise during the Rhodesian crisis, especially in the years of 1965−1966, Ian Smith, Prime Minister of the white minority in Rhodesia, and the English jammed each other's local MW transmissions.

Also Finnish broadcasts were jammed

The following reference was mentioned in the magazine Radiomaailma 11−12/1996, pp. 24−25: John I. Kolehmainen, *The Voice of America calling Finland.* New York Mills, 128 pages. The Finnish-language transmissions "America calling Finland" (ACF) began on 16 April 1942. The editorial office of the Finnish transmissions was located in the GM Building in New York and their first editor was William Reivo. In March 1943 Eero Pulli was hired for the task. The ACF transmissions were jammed and so they were moved to be relayed by BBC as early as the summer of 1942. The ACF broadcasts ended on 10 November 1945. Oddly enough, the three-part history of the Finnish Broadcasting Company, published in 1996 (over 1,000 pages in all), does not mention the ACF transmissions; however, BBC's own transmissions via Daventry are included, though.

Unravelling the geographical origins of jamming in the Soviet Union can be rather casual at this point. Thanks to Pleikys, details from early years have been collected from Lithuanian station operators. The USSR was jamming, for instance, the Lithuanian-language broadcasts of Vatican

Radio, not only after Lithuania was incorporated into the USSR in 1945 but also as early as 1940 when the USSR invaded the country for the first time. The same sources say that, already as early as 1939, Russian-language broadcasts that were edited in Paris, had been jammed. Jamming on a bigger scale from the Lithuanian territory had started in 1951 when even American-made BC-610 surplus transmitters of only 500 Watts were used.

Radio broadcasting from the Holy See is an interesting story in itself. Pope Pius XI had declared on 12 February 1931 that broadcasts from Vatican Radio had started. Guglielmo Marconi himself had proposed the foundation of the station and acted as an advisor. He had also recommended to the Pope that the Jesuit priest Gianfranceschi be appointed the director of the radio. The term "propaganda", by the way, comes just from the vocabulary of the Catholic church /10/.

On 24 February 1942 the newly-founded VOA had started German and English language broadcasts and rather soon afterwards also French language broadcasts. The first Russian-language broadcast took place on 17 February 1947 with three 85-kW transmitters in Munich, and after three weeks of training in the Manhattan studios. On the other hand, BBC had started its Russian Service on 24 March 1946 but, for instance, the Vatican already on 19 April 1943. The source in the note /10/ says that jamming against VOA Russian transmissions would have started on 3 February 1948 and partial jamming against BBC transmissions on 13 April 1948.

Photo 4. Equipment used for jamming at the Laitse transmitting station in Tallinn.

Longwaves as merchandise

Some people think that the frequency of 173 kHz was assigned to the USSR in the notorious European LW/MW Conference in Copenhagen in 1948. The VOA station, built in Erching (Munich) and equipped with a 1,000-kW Continental transmitter, was operating on the same frequency. The Erching LW transmitter was even switched off a couple of times when it was obviously agreed that some of the HF broadcasts will not be jammed. In 1963 the power of the Erching station was temporarily dropped to 50 kW. This, a certain type of the cat-and-mouse game, continued until the end of the 1980s. Another VOA station, which is also located in Munich (Ismaning) and started on 1 September 1949, still operates on the frequency of 1197 kHz.
In the conference mentioned above (and even before it), it has been claimed that Hella Wuolijoki would have "done business" with the then frequency of Lahti /9/. In any case, Lahti was forced to move from the one end of the LW band to the other, from the frequency of 160 kHz to the frequency of 254 kHz (15 March 1950) on which many Soviet stations were operating.

It should be borne in mind that both the German states were not among signatory countries in the Copenhagen conference. Of course, the USSR was but, as usual, with extra conditions that were beyond comprehension of the majority of others. The concept that the USSR geographically belongs to Europe is (still) at least rather elastic.

For the Soviet Union it was extremely rewarding to plead really high-power LW and MW broadcasting stations that operated in geographically very small countries; stations that, for some reason, had been considered in an international setting to have an approved right to pursue radio broadcasting. Countries belonging to this category were, for instance, Luxembourg, Monaco, Saarbrücken and even the Vatican. Some people said that the goals and the ownership of the stations mentioned did not stand critical scrutiny. The original purpose of LW stations in particular was to ensure a fair coverage for one's national (primary) channel in each individual country.

Notes

/1/ Just a brief chronological summary: from 19 June 1963 to 19 August 1968, among the Russian-language (plus "sub-languages") broadcasts not being jammed were VOA, BBC, DW; jamming resumed on the day of the invasion of Czechoslovakia. Jamming ended: (BBC) 20 January 1987; (VOA) 23 May 1987; Polish-language broadcasts of VOA, BBC and RFE: 1 January 1988. The actual high-power jamming transmitters were switched off on 29 November 1988 at 21 UTC (RL, DW, Kol Israel). In one YLE documentary the date given was 28 October 1988 (?); in any event, it was a historic moment.

Jamming against Bulgarian-language broadcasts was ended last (RFE, IBRA, etc.) on 21 December 1988 at 16 UTC; nevertheless, still on the Christmas of 1988 the jamming stations L4, K7, R6, M7 and G2 were heard harassing the Bulgarian-language broadcasts of the Vatican, Tirana and others.

From 1973 to 1980 jamming against VOA and BBC stations was very occasional. Please note the situation in Afghanistan and Poland in 1980−1981. Solidarnosc was founded on 17 September 1980 and was forbidden as soon as the martial law commenced in Poland on 13 December 1981.

It is very interesting that President Mikhail Sergevich Gorbachev, while speaking in the United Nations, New York on 8 December 1988, announced that "the Soviet Union is considering to stop jamming against foreign radio broadcasts, directed to the country." Both the UN Secretary-General and obviously also others present were well aware that actual massive jamming had already been ceased ten days earlier.

Pleikys and also others find it a kind of a miracle that jamming against RIAS Berlin broadcasts, jamming that already started in 1951, ended as early as 23 November 1978, i.e. when the European LW and MW Plan from 1975 had taken effect. I found some photographs I took of these "miracles of Stasi" at that time. The photographs show low-power AM transmitters located between 650 and 800 Hz on both sides of the RIAS carrier wave, for instance on the frequencies of 683, 854 and 989 kHz (see photo 5).

RIAS had started some kind of telephone network transmissions on 7 February 1946 (DIAS, Drahtfunk im Amerikanischen Sektor). However, in the end of 1946, MF and HF transmissions were started in the American Sector. FM transmissions were started in the 1950s and TV transmissions on 10 November 1986. RIAS was incorporated into other German radio stations on 18 May 1992.

Photo 5. A spectrum photo taken in 1975. Many carrier waves are visible around the RIAS Berlin frequency of 989 kHz. Some of the carriers were broadcasting East German radio programmes, in most cases from Berliner Rundfunk.

/2/ Mary W. Sowers, G. Hand & C. M. Rush (NTIA/ITS). *Jamming to the HF Broadcasting Service*. IEEE Transactions on Broadcasting, vol. 24, No 2, June 1988 (7 references). The coordination and handling of the results of jamming monitoring was assigned to these researchers. Of the authors, Gregory Hand is also presently the contact person for the VOACAP and ICEPAC HF propagation software. Dr. Rush is a respected authority in propagation issues.

Those jamming stations in particular that operated in the actual Soviet territory gave a two-letter ID (usually two times) twice a minute, e.g. UG UG. Other ID combinations included a letter and a number (e.g. K7) or a number and a letter (e.g. 4L). In most cases, stations using numbers were originally located in so called satellite countries.

The jammer IDs were normally changed on the 4th and 19th day of the month at 21 UTC. For instance in the 1960s, the (surface-wave) jamming station that was the worst interference against the frequency of 1196 in Estonia had the IDs of either NB or VA (in Morse they are, by coincidence, mirror images: −. −... and ...− .−). Examples of other ID pairs from the 1960s: NS-BU, UH-ZG, and DH-BW. Examples of local jamming stations: D3 operated in Prague, I2 in Hradec Kralove, P2 in Ceské Budekovice, G2 in Sofia and so on. Photo 4 shows equipment used for jamming at the Laitse transmitting station near Tallinn.

Single-letter morse IDs have become more familiar in conjunction with so called Single-Letter HF Beacons (SLHFB). Pleikys says that the beacons equipped with the ID of "U" had been reserve channels for the jamming control stations, and they vanished from the air in the spring of 1990. According to my own logbook I had recorded them at least on 17 different frequencies between 3635.5 and 12186.5 kHz. At that time also disappeared the beacon "K" that operated in the Far East. Today, you can hear cluster beacons such as "C", "S", "P" and "F". There are individual beacons as well, for instance "R" or "V". The mysteries of these channel marker stations were discussed by, among others, one of the world famous radio amateurs Bill Orr W6SAI in his writings. Perhaps there is reason to remind that so called international Morse codes are not compatible with the Russian alphabets. For instance, the Morse letter ––.− (Q) is the Russian щ, "shch"; the Morse letter −.−. (C) is ц, "ts"; ...− (V) is ж, or the voiced "zh".

/3/ Rimantas Pleikys is not just any DX listener. He is a member of the Lithuanian Parliament and serves as a member of its Committee for National Security. He is also former Minister for Communications and Informatics. His 164-page book "Jamming", that was published in the autumn of 1998, perhaps surprised the group of about dozen professional monitors still alive. The highlights for them may be, among others, copies of Russian-language orders to stop jamming, and other documents as well as, citing Pleikys' own words, "some other documents that have miraculously preserved", documents that were found in the office premises of the Lithuanian Ministry of Communications. All other material (at least one lorryload) was, it is said, ground into pieces a bit earlier at the Grigiskes paper mill. There was a brief presentation of Pleikys' book in Radiomaailma 1/99 by Risto Vähäkainu.

Pleikys had of course an enviable opportunity to make interviews, for instance, with Lithuanian veterans (mentioned by name in the book) that worked at the jamming stations. Pleikys says that the (jamming) transmitting station usually received the order from the control station to tune the transmitter in this or that frequency. Among other things, the jamming modulation, ID and tuning signals for the RF stages came via (audio) cables directly to the transmitter. Radio Liberty frequencies in particular were jammed with "white noise" (our own term was "diesel"). The EBU document (Draft Tech. 342-E) lists over a dozen different modes of jamming modulations such as warbler, wobbler, babble, or Mayak. Mayak (beacon, lighthouse) is a 24-hour news and music programme from Moscow that started on 1 August 1964 as a weapon against "the Western propaganda". The intentionally distorted version of the programme (even in FM modulation) may have been used for jamming from its very beginning. Pleikys says that the Mayak jammer was not, however, in all cases as efficient as the "diesel", and it was not used against Radio Liberty broadcasts, for instance. The latest CD-ROM edition of the WUN (Worldwide UTE News) from 1999 has also many audio samples of jamming stations in WAV format.

Interesting are the vague answers that Pleikys received for his persistent letter and telephone inquiries in 1977 from Russia, Poland and elsewhere. The answers stated that either the jamming employees had retired (Moscow) or jamming was handled by some other party (Poland, etc.). Pleikys has very cleverly used quite a large portion of his book (more than 60 pages) for solving the origin of the music programme (so called Polish Polka) which was used for jamming the Polish-language broadcasts of RFE as well as the locations, IDs etc. of the jamming transmitting stations.

Poland is the neighbour of Lithuania, and Pleikys can, besides Russian, also probably speak some Polish. Music jamming against the Polish-language broadcasts of RFE was on the air from the winter of 1970 to 20 August 1980 when it changed to a certain type of "Russian speech". It was said that the latter, the "rechepodobny signal" type of a jamming sound, was achieved by acoustically combining a huge amount of the voices of the announcers from the USSR.
Madame Krestyaninova, on her part, had agreed to remember that "only the Polish-language broadcasts were jammed with music instead of the GMD" (an abbreviation from the Russian words for "the jamming effect generator"). Also Madame had remembered that the powers of the jamming transmitters did not exceed 120 kW at any time. In April 1997 Minister Pleikys' assisting colleague had happened to find in his papers three Moscow telephone numbers that were connected with the RU-2 (Radio Directorate 2) department, i.e. the jamming department where Krestyaninova, among others, had been working only a little earlier.

On pages 56 and 57 in his book Pleikys discusses the presence of so-called "selective jamming" with certain reservations. According to my note /8/, it certainly took place at least during the time period of 16 April 1959 − 18 June 1963 (on which day, among other things, jamming against the VOA Russian Service ended). At least jamming against Russian and Ukrainian language broadcasts, which were mostly 30 minutes long, was mentioned in 1 to 3 instances of varying length in the logbook. Whether selective jamming depended upon the need for saving the electricity, on the programme contents or on what reason, is somewhat unclear. At the same time, VOA broadcasts in Baltic languages were jammed from beginning to end. Pleikys may not have been familiar with antenna engineering because he, for instance, calls standing waves "running waves"; also calling the curtain antenna − the most common BC transmitter antenna type − "vertical" gives rise to misunderstandings. For instance, the first part of the abbreviation HR 4/4/1 refers to the words "Horizontal with Reflector Curtain". The radio engineering vocabulary used in the USSR differs, to some degree, from the Western one.

/4/ Stanley Leinwoll used to be the VOA frequency manager before likewise famous George Jacobs (W3ASK). RFE had a monitoring station in Schleissheim, which started operations on 15 August 1951, that, among other things, produced band maps as described on the page 95 of the note /2/. I remember that there was a Collins 51J receiver standing on Leinwoll's desk when I, without a prior warning, paid my respects to him in his office on the Broadway in New York in the summer of 1966. Both the gentlemen are still admiringly keen on HF broadcasting. They also participated in the activities of the High Frequency Coordinating Committee, which the EBU got started at last in 1991 under the coordination of the Czech veteran, Oldrich Cip.

Photo 6. Photographing wire antennas is, as we know, an extremely unrewarding task. This is one of the most successful shots that I have seen; the wire jungle at the Pedrozavodsk "Mäntyniemi" station.

/5/ In 1971, Ville Zilliacus (of YLE) had prepared a brief but an interesting writing − "A memorandum on some foreign broadcasting stations operating in the European territory" − where the stations were grouped into five categories: 1. The radio and TV war in the Berlin region (RIAS, AFN, AFRT, SFB, BFBS, RFB et al); 2. Stations operating as part of government radio monopolies or comparable corporations (institutions) and funded by various means (DF, DW, BBC, DS, RBI, Radio Volga et al); 3. Stations with religious programming (Radio Vatican, IBRA, Norea, TWR); 4. Commercial (entertaining) stations (RTL, Radio Europe 1, Monaco et al) and 5. A category of its own (RL, RFE, VOA and "Peace and Progress" of Moscow). Personally I had an opportunity to make some additions to the well-written article which totally failed to mention, for instance, clandestine stations. Among the first clandestines probably were "Radio España Independiente" (started operations already in 1941), "Radio Portugal Livre" (1962), "Deutscher Freiheitssender 904" (1956−), "Deutscher Soldatensender" (1960−) plus many others.

After having reflected upon the resolutions of the OIRT General Assembly in Varna, the coming Munich Olympics (1972) and the Soviet irritation towards RL/RFE programming, Zilliacus writes, "It has been asserted that Bonn has begun to think how the foreign-government-funded radio stations in the German territory fit into the image of an independent country. Likewise it has been thought that their days (of RL/RFE) are numbered. Both RFE and RL are, by their own account, independent. There is, however, an agreement from 1955 that gives the West German authorities the right to inspect in advance all RFE recording tapes. This may have taken place only once, i.e. when the authorities wanted to inspect during and after the so-called Hungary crisis (1956), whether RFE possibly had any share in the events in Hungary. It was found that this was not the case." Please note that there is a plenty of mentions in the note /10/ about this as well as the radios of "Free Hungary".

/6/ *The National Committee for a Free Europe* was founded in June 1949. When attempts to hire broadcasting time from three commercial radio stations had failed, Radio Free Europe (RFE) started broadcasts of its own to Czechoslovakia from Lampertheim, the ex-air base of Luftwaffe, on 4 July 1950. The pet name of the 7.5-kW RCA transmitter was "Barbara". On 14 July 1950 broadcasts were started to Romania, on 4 August 1950 to Hungary and Poland, and on 11 August 1950 to Bulgaria. In November 1950 in Biblis there were already three 10-kW transmitters and one 50-kW transmitter in use. On 4 July 1951 broadcasts were started from Portugal (Gloria, Lisbon). The 135-kW MW station in Holzkirchen near Munich on 719 kHz started in May 1951. RFE programming has always had a lot of light music and sports.

The American Committee for Freedom for the Peoples of the USSR was founded in 1951, and Radio Liberty (RL) started transmissions on 1 March 1953, just 4 days before Stalin's death. Until 1964 the station was called Liberation, and the operations were partly funded by donations (from emigrants, etc.). For instance in 1970, RL transmitted in altogether 17 languages and dialects that were spoken in the Soviet territory. The broadcasting operations were centered, besides Lampertheim, mainly in Spain (Playa de Pals, from 1960).

In principle, the US government funded both operations, until 1971 probably via the CIA (which did give rise to remarks) /10/. RFE and RL were merged into each other on 1 October 1976. The studios and offices were for a long time in Munich until the majority of operations was moved to Prague in 1995. After the fall of the Soviet Union, FM broadcasting time has been bought in the target countries, likewise MW broadcasting time especially in Russia. In the night of 21 February 1981, an approximately 20-kg plastic bomb that exploded in the inner court of the RFE/RL building had damaged the building. One of the suspects was the Venezuelan terrorist Carlos (aka Jackal) who was claimed to have worked by order of the Romanian President Ceausescu (according to Stasi archives, for a charge of one million US dollars).

In past years, there was a clandestine station called "Radio Free Russia", and now there is Russia's own external service called "Voice of Russia". So it is not a surprise that one may get confused with the names. In principle, the term "clandestine" refers to an illegal station which constantly tries to give a false picture of the origin of the programme and the location of the transmitter.

/7/ As a good example, the *Helsingin Sanomat* newspaper had a five-column article about the backgrounds of broadcasting in Albania, this extraordinary country, entitled "Radio Tirana is a heavyweight enterprise". The current situation is different in every way. For instance, TWR, headquartered in Monte Carlo, has probably bought most of Albania's real high-power transmitters for its own use.

Photo 7. Two versions of the Soviet "Nadenenko" broad-band dipole construction. Similar constructions are naturally in use elsewhere in the world, too.

/8/ The monitoring diaries, i.e. logbooks from 9 October 1957 to 31 December 1964, from the VOA (IBS) Helsinki monitoring station were found for study. The material consists of altogether 17 spiral-bound notebooks with hand-written daily notes. Miscellaneous, partly rather comprehensive summaries about the current jamming situation at that time were found from the years 1981−1991. Some examples of those follow. During the years 1983−1984, jamming was heard on altogether 62 different frequencies on the mediumwaves (MW) alone. It was directed to different countries as follows: on 34 frequencies the target was Iran, on 11 frequencies Iraq, on 3 frequencies China, for instance, the famous Urumqi station on 1520/1521 kHz. At some point China played its Russian language programme tapes backwards in which case the broadcast was hardly jammed. These logbooks do not, in all respects, verify the jamming pauses during state visits etc. that were mentioned in Pleikys' book on page 17. Throughout the year of 1990 jamming was heard on altogether 35 MW frequencies which apparently originated only from Iraq. The note /12/ talks more about the events in 1990−1991.

/9/ Hella Wuolijoki (1886−1954, originally Ella Maria Murrik), being forced to resign from the position of YLE Director-General, expressed in her farewell speech in 1949 that "In the Copenhagen Conference last summer, with the Soviet support to be sure, we were given the best wavelength for Lahti it has ever had." A note about the frequency issue, see V. K. Lehtoranta, *Lahden pitkäaaltoaseman taajuushistoria lyhyesti* (*The brief frequency history of the Lahti LW station*), SRHS Bulletin no. 4/1995, pp. 4−9.

/10/ Michael Nelson, *War of the Black Heavens, The Battles of Western Broadcasting in the Cold War, 1945−1961*. Syracuse University Press 1997, 277 pages. Altogether 925 enumerated notes. Bibliography: 22 pages.

/11/ Walter L. Hixon, *Parting the Curtain; Propaganda, Culture and the Cold War*. St. Martin's Griffin, New York. January 1998, 283 pages. Altogether 711 enumerated notes.

The books in /10/ and /11/ are also individually much more comprehensive, especially with regards to jamming, than the book mentioned by Pleikys in his book: Alwin A. Snyder, *Warriors of Disinformation*. Arcade Publishing, New York 1995. 321 pages. 509 notes. Snyder's book primarily focusses on the years 1982−1988 and on the personality of the then USIA director, Charles Z. Wick.

/12/ Finnish Broadcasting Company (YLE) Monitoring Station. Kari Hautala, Bulletin 31/91 (23 May 1991), *Persianlahden sodan vaikutuksista yleisradiotoimintaan lyhyt-, keski- ja pitkäaaltoalueilla* (*On the effects of the Gulf War on radio broadcasting on the HF, MF and LF bands*), with enclosures, 12 pages. Before the Iraqi invasion of Kuwait (2 August 1990), among the Arabic language broadcasts under jamming were VOA, BBC, Egypt and also Iraq. When the war began, in addition at least Syria, Saudi Arabia and many clandestines were being jammed. One peculiar detail was that as of 10 August 1990 the coalition forces jammed Iraqi broadcasts on USB, which means that the broadcasts were audible on LSB but not on the ordinary AM mode.

This article ends with a citation from the DX-Kuuntelija (SWL) magazine, 4/1989, p. 52. In the magazine, Vladimir Heinrichsen (not Heinrichs), a docent in the Department of Radio and Communication Engineering at the Tallinn University of Technology says that "Everybody knows that the transmitter station no. 15 in Tallinn was used for radio broadcasting jamming. They used quite common noise generators (*melugeneraattori*) which are one of the most important research tools in radio engineering. Using them for good or bad depends on the human jugdment. I am now very pleased that they return to their original role as a pure research tool."

In the Finnish vocabulary, familiar to all is a measuring device called "kohinageneraattori" (*noise generator*). As far as is known, in a Moscow institute there was really a group whose purpose was to constantly develop noise generators, that is, different variations of the GMD. The time may yet come when we will know all that the tailor-made "diesel" sound, which was most used for jamming RL frequencies, in fact, contained.

References to the Web

− The following email address is given for Rimantas Pleikys: Pleikys@BalticWaves.cjb.net and the home page of his book is located at http://www.zilionis.com/jamming/ (The book "Jamming" is sold at EUR 19.00 / USD 25.00 / GBP 13.00 (plus EUR/$/£ 2.00 in case of airmail delivery). There are links to copies of maps, terrain photos, etc.

− The current jamming situation on broadcast bands with RealAudio audio samples: http://monitor.ibb.gov/jamming/

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